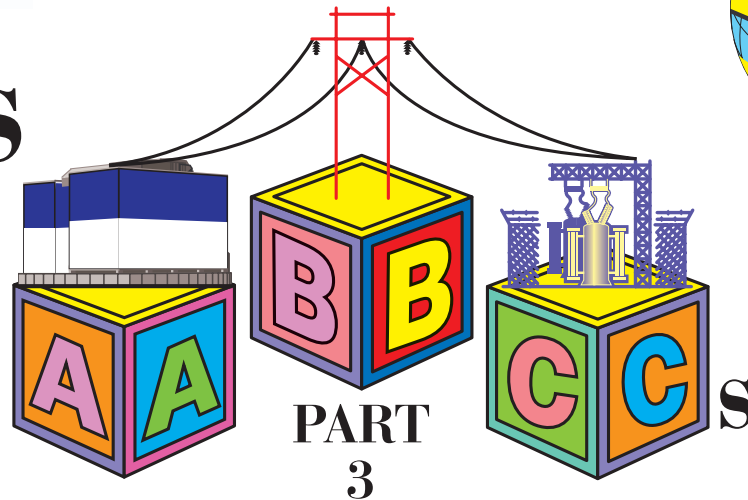


South Carolina's co-op network has enough lines to wrap the Earth more than 2½ times.

Power's

Third in a three-part series about how electricity is produced, transmitted and delivered to cooperative members



By David Logeman and John Bruce

Just how does electricity move around? How does it get from the point where it is generated to the point where it's consumed?

The first installment of this three-part series of articles, on where power comes from, looked at the generation of power. The second article examined how electricity moves from a generator across a network of high-power transmission lines to substations, where the voltage is lowered. This third and final article looks at how power ultimately gets distributed to homes and businesses of cooperative members.

An explanation of electric power distribution would be incomplete without an insight into its remarkable history. The previous article in this series mentioned Thomas Alva Edison's part in the pioneering of electric power. But it was not Edison who made your electric cooperative's power distribution grid possible. In fact, today's system of power distribution came about largely in spite of Edison.

Power's real hero

Inventing the light bulb was one thing, but getting electricity to a home was another matter entirely. Edison's direct current (DC) system of power distribution was riddled with problems. DC power lines longer than a mile were impractical. Edison's system was good for little more than powering light bulbs. DC lights and DC motors required separate power lines. If Edison's original power delivery grid had gone on as he had intended, the result would have been

disastrous. A tangled spaghetti pile of power cables and generators would crowd the world in a tremendously dangerous waste of money and space.

In 1884, five years after inventing the light bulb, the demand for power was booming. Edison believed he needed someone to redesign the Edison Company generators. On recommendation from an associate in Europe, Edison hired one Nikola Tesla, a 28-year-old Serbian immigrant. Four years earlier, after graduating from one of Europe's most prestigious polytechnic schools, Tesla had conceived the idea of "polyphase" electric power. With electrons flowing in alternating phases, or waves, of current, Tesla's alternating current (AC) power system would forever change the world.

Even as he hired Tesla, Edison scoffed at the notion of AC power. Legend has it that Edison offered Tesla \$50,000 for the job of redesigning his generators. Tesla worked on the project about a year before becoming the butt of an Edison joke. When Tesla told Edison his job was completed, he asked about his money. Edison offered Tesla a \$10 weekly pay raise instead of the \$50,000. "You don't understand our American humor," Edison told Tesla. Furious, Tesla resigned without notice.

Tesla's inventions including the AC power distribution system within four years had

won the most valuable patents since the telephone. His most famous invention was alternating current (AC) power, which made practical the long-distance distribution and delivery of electricity, the lifeblood of modern civilization, to homes and businesses. Little did Tesla know then that his work would make electric cooperatives possible.

Current competition

As Tesla's first AC system was first being demonstrated, Edison, who was not to be outdone, was pouring considerable resources into a futile promotion of his DC current. He went so far as to wage a bizarre public relations campaign to disparage AC power by staging electrocutions of stray cats and dogs — once even an elephant — before members of the press. Ironically, Edison had opposed the death penalty, but he was so obsessed with debunking Tesla and George Westinghouse, who sold Tesla's AC power system, that the Edison Company went on to invent an AC electric chair to persuade the public to believe that AC was deadlier than DC.

Edison was too late. Tesla's AC power was starting to become America's electric power standard. The Tesla system won the contract for the world's first hydroelectric project against other systems, including Edison's. Tesla had envisioned harnessing Niagara Falls as a child growing up in what is now Croatia. Tycoons with names including Astor, Morgan, Rothchild and Vanderbilt backed the project, which was fraught with doubt (to everyone except Tesla) up to its completion in 1896. At midnight on November 16, commercial AC power was delivered



Nikola Tesla

for the first time. The first block of power went to the streetcar system of Buffalo, New York, some 20 miles away.

Soon, the Niagara Falls Project was complete. AC power soon reached New York City. Nights on Broadway were now bright with AC-powered lamps. Streetcars and subway trains purred with the power of AC motors. Even Edison's DC systems converted to AC power. The role of DC power now was relegated to use in cars, trucks and electric appliances.

Electricity in South Carolina would first flow to textile mills in the Upstate. In 1897, the world's first electric cotton gin powered up in Anderson County. The county seat of Anderson gained the nickname, "The Electric City," which it still holds. The city was the first in the state to sell power to light up homes and businesses.

The picture was not as bright elsewhere in the Palmetto State during those days. Utilities knew they could not profit by running lines into the countryside where homes were so far apart. Power companies were connecting 25 or more city homes per mile of line. There would be only about five per mile outside the city. Without laborsaving devices made possible by electricity, the standard of living throughout most of the state continued much as it had during the 19th century and the decades of poverty, hunger, sickness and misery after the Civil War.

People living in these vast reaches of South Carolina realized that the only way to get power in their homes was to bring it themselves. They created a new kind of electric service provider, called an electric cooperative, which procures power and delivers it to its members. Seeds of the first electric cooperative in South Carolina sprouted during recovery from the Great Depression. In 1937, four decades after power reached Anderson County, people in Aiken County began meeting to learn how to get lights in their homes.

Aiken Electric Cooperative energized its first line on November 8, 1938, to provide the first co-op electric service in the state. Munson Morris, the first president of Aiken Electric Cooperative, was a friend of President Franklin D. Roosevelt, whose New Deal paved the way for South Carolinians to

organize electric cooperatives. By the early 1950s, electric cooperatives had begun serving members in every county in South Carolina. Today, more than 1.3 million South Carolinians receive power from the state's 20 electric cooperatives, which operate the largest electric distribution network in the state with more than 66,000 miles of lines.

Electric cooperatives use Tesla's polyphase system as a means of distributing AC electric power. The most common examples of polyphase systems are single and three-



A newly installed transformer box in fast-growing Horry County is one of thousands of pieces of equipment that cooperatives install yearly to keep pace with population growth.

phase power systems used in homes, small businesses and large industries. Wooden poles and buried cables support a grid of wires and other equipment to deliver safe and reliable electricity. On a pole or concrete pad, transformers are used to reduce the power's voltage. The higher the voltage, the farther power can be transmitted. But electrical devices can use power only at lower voltages. A distribution system transformer steps down the voltage from distribution levels, usually 7,200 volts, to voltages used in a home or business, usually 120 volts.

Your co-op's role

Your cooperative follows a strict regimen of business practices to ensure that your electric service quality remains consistently high. For instance, a planned program of vegetation control and right-of-way maintenance helps prevent outages by keeping tree limbs away from power lines. Cooperative members are encouraged to help keep the lights on by allowing authorized personnel on their land to carry out this program. The cooperative conducts consumer research and employs new technologies to meet

member needs. Gathering information on members' appliances enables the cooperative to custom-build and update the power distribution system. The cooperative is dedicated to ensuring that power flows to members safely, efficiently, reliably and at the lowest possible cost.

South Carolina's population growth poses special challenges. Cooperatives are growing at more than twice the rate of investor-owned utilities but serve a far lower density of consumers. Poles, wires, transformers and underground cable and all the other equipment needed to support Tesla's AC power distribution system must be economically priced so as to keep costs down. A specialized equipment purchasing cooperative, Cooperative Electric Energy Utility Supply (CEE-US), provides at-cost distribution system materials and services to electric cooperatives.

Because your electric cooperative is member-owned and not-for-profit, it works together with other cooperatives through state and national entities to pool their resources and hold down costs. Examples include The Electric Cooperatives of

South Carolina and National Rural Electric Cooperative Association. Another example is a cooperative financial institution, National Rural Utilities Cooperative Finance Corporation, which provides low-cost financing for cooperatives to operate and maintain Tesla's AC power distribution system.

Half a decade after co-op electricity arrived in South Carolina, Tesla died at age 86. He was destitute, despite having earned 275 patents in 25 countries, including his "System of Electrical Distribution," which was patented May 1, 1888, in the United States.

The year 2006 marks the anniversary of Tesla's 150th birthday. Happy birthday, Niko.

David Logeman is director of power supply for Central Electric Power Cooperative. John Bruce is the editor of this magazine. To learn about Tesla and his inventions, log onto www.pbs.org/tesla/index.html and http://en.wikipedia.org/wiki/Nikola_Tesla. For information on electric cooperatives, log onto www.ecsc.org. ↑